SIBOGA-EXPEDITIE.

Siboga-Expeditie

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Siboga-Expeditie
VIa²

THE

PORIFERA OF THE SIBOGA EXPEDITION

III

CALCAREA

BY

MAURICE BURTON, M. Sc.
Assistant-Keeper, Department of Zoology, British Museum (Natural History), London

With 8 textfigures

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The Calcarea of the Siboga Expedition are surprisingly few in number, only thirty-three specimens being found, representing eleven species. At the same time, the number of species hitherto recorded for the same area was only nine. In view of the richness of the faunas of the Indian Ocean and Australia in species of Calcareous sponges, there can be little doubt that the twenty recorded species do not represent anything like the complete list for the Indo-Pacific area.

Of these twenty, nine are known, or may be presumed, to be cosmopolitan, or nearly so. Four have been previously recorded from Australia, two from the Indian Ocean, one from the Philippines, and one from Japan. Three only, of which two are new with this report, are exclusive to the Indo-Pacific.

LIST OF CALCAREA RECORDED FROM THE INDO-PACIFIC.

* obtained by the Siboga Expedition.

**Leucosolenia coriacea* (Montagu).
Leucosolenia clathrus (Schmidt).
Leucosolenia primordialis (Haeckel).
Leucosolenia cerebrum (Haeckel).
**Leucosolenia macleayi* (Lendenfeld).
**Dendya prolifera* Dendy.
**Pericharax heterorhaphis* (Poléjaeff).
Leucetta solida (Schmidt).
Sycon raphanus Schmidt.
**Grantessa sibogae* sp. n.
**Heteropia striata* Hozawa var. *minor* var. n.
**Uteopsis argentea* (Poléjaeff).
Grantia capillosa (Schmidt).
Leuconia pumila (Bowerbank)
**Leuconia capillata* (Poléjaeff).
**Anamixilla torresi* (Poléjaeff).
**Anamixilla irregularis* sp. n.
Eilhardia schulzei Poléjaeff.
Amphoriscus semoni Breitfuss.
**Leucilla australiensis* (Carter).

PORIFERA.

Order CALCAREA.

Family Homocœlidae Dendy and Row.

Leucosolenia Bowerbank.

1. *Leucosolenia coriacea* (Montagu).

Montagu. An Essay on Sponges. Wernerian Memoirs. 1818, Vol. II, p. 116.
Arnesen. Spongien fra den norske kyst. Bergens Museum Aarbog. 1900, N° V, p. 10.
Burton. Porifera. Antarctic Sponges, Part II, Brit. Antarctic („Terra Nova") Exped. Vol. VI, N° 4, p. 402.

Stat. 213. Saleyer, Zuid Eiland. 1 Ex.
Stat. 313. Saleh Bay. Up to 36 Meter. 1 Ex.

It is hardly necessary to give a complete list of synonyms of so well-known a species, and the works quoted above will be found to contain the principal references to *L. coriacea*. Although there are many parts of the world from which there is no record of this species, there can be little doubt that it is almost cosmopolitan.

The Siboga examples are quite typical.

2. *Leucosolenia macleayi* (Lendenfeld).

For synonymy see p. 14.

Stat. 129. Karkaralong Islands. 23—31 Meter. 1 Ex.

The single specimen is almost identical with the holotype of *L. stipitata* Dendy, here regarded as a synonym of *L. macleayi* (see p. 14), in both spiculation and external form. There is, however, no sign of an exhalant aperture. The sponge is 10 cms. high and pure white in colour.

Dendya Bidder.

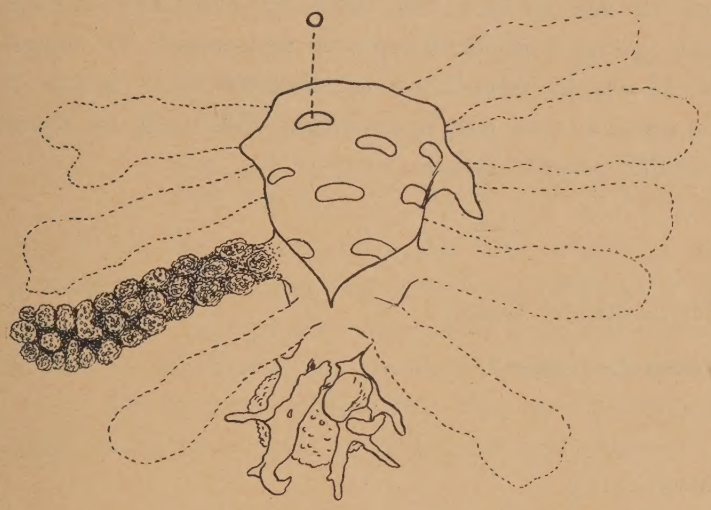
3. *Dendya prolifera* Dendy. (Text-figs. 1, 2).

Dendy. Report of the Calcareous Sponges collected by H. M. S. "Sealark" in the Indian Ocean. Trans. Linn. Soc. London, Vol. XVI, Part. I, N° I, 1913, p. 6.

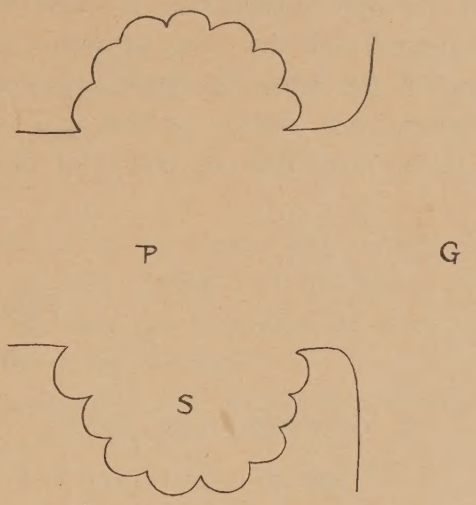
Stat. 164. 1°42′.5 S., 130°47′.5 E. 32 Meter. 1 Ex.
Stat. 301. 10°38′ S., 123°25′.2 E. Pepela Bay, Rotti Island. 22 Meter. 1 Ex.

The present specimens are much more complete than the holotype and show that the

form of the sponge is markedly different from that described by DENDY. It consist of a central sac-shaped body, with smooth, thin walls, whose cavity communicates directly, through a number of reniform apertures (fig. 1, o), with numerous diverticula arising from the central body and disposed at right angles to it. These diverticula are sufficiently numerous to obscure, almost



Text-fig. 1. *Dendya prolifera* Dendy.
Central cavity cut open to show reniform openings into diverticula (o).



Text-fig. 2. *Dendya prolifera* Dendy. Diagrammatic section through base of one of diverticula showing (*G*) central cavity, (*P*) lumen of primary diverticulum, and (*S*) cavity of secondary diverticulum.

completely, the central body. The holotype consisted of one only of these diverticula which had been damaged at each end.

These diverticula, the primary diverticula, are thin-walled and hollow, and bear on their surfaces numerous secondary diverticula, each enclosing a rounded cavity, and the walls of the secondary diverticula are again thrown into tertiary diverticula.

The structure of this sponge is strongly reminiscent of that of a mammalian lung and represents, no doubt, a high degree of specialization among the Homocœlidae, whereby a considerably increased surface is exposed to the water-currents circulating through the sponge.

Species previously recorded from the Seychelles.

Family LEUCASIDAE Dendy.

Pericharax Poléjaeff.

4. *Pericharax heterorhaphis* (Poléjaeff).

POLÉJAEFF. Challenger Reports. Calcarea. Vol. VIII, 1884, p. 66.
DENDY. Report of the Calcareous Sponges collected by H. M. S. "Sealark" in the Indian Ocean. Trans. Linn. Soc. London, Vol. XVI, Part. I, N° I, 1913, p. 13.

Stat. 99. 6° 7′.5 N., 120° 26′ E. North Ubian Island. 16—23 Meter. 2 Ex.
Stat. 164. 1° 42′.5 S., 130° 47′.5 E. 32 Meter. 4 Ex.
Stat. 273. Jedan Island, Aru Islands.
Stat. 299. 10° 52′.4 S., 123° 1′.1 E. Rotti Island. 34 Meter. 8 Ex.
Stat. 311. Sapeh Bay, Sumbawa Island. Up to 36 Meter. 1 Ex.

The numerous specimens of this species are all quite typical in so far as the spiculation is concerned. In external form they show certain differences worthy of notice. Only two of them are, like the holotype, single individuals. The remainder, either by budding or the coalescence of adjacent individuals, probably the latter, have given rise to masses of rounded lobes, each with its own conspicuous, rounded osculum. In one of them, the lobes have become laterally compressed and the vents somewhat reduced, giving a decidedly atypical appearance. In others, some of the lobes, by the enlargement of the oscule, have come to resemble the holotype of *P. peziza* very closely, so that it is not improbable that that species may eventually be found to be no more than an ecological variety of the present species.

Family Heteropiidae Dendy.

Grantessa Lendenfeld.

5. *Grantessa sibogae* sp. n.

Stat. 77. 3° 27′ S., 117° 36′ E. 59 Meter. 1 Ex.

Diagnosis. — Sponge an erect, elongated, narrow tube; margin of oscule without fringe of spicules; surface even, harsh to touch; colour, in spirit, white; dermal skeleton a tangential layer of equiangular triradiates, mostly of large size, with rays more or less of equal length measuring up to .4 by .036 mm.; skeleton of chamber-layer composed of subdermal pseudosagittal triradiates and subgastral sagittal triradiates of similar proportions, with basal ray up to .42 by .024 mm., and oral rays up to .24 by .018 mm.; gastral triradiates arranged tangentially to gastral surface, with rays about .12 mm. long.

The species is very like *G. intusarticulata* in many respects but differs from it in the absence of triradiates other than the subdermal and subgastral sagittals in the chamber layer, and in the presence of trichoxea instead of microxea. In the structure of the skeleton, the present species bears a closer resemblance to *G. simplex* Jenkins from Zanzibar, from which it differs in the presence of the trichoxea and the larger dimensions of the other spicules.

Heteropia Carter.

6. *Heteropia striata* Hozawa var. *minor* var. n.

Stat. 282. 8° 25′.2 S., 127° 18′.4 E. 27—54 Meter. 1 Ex.

The new variety is based on a few small fragments of a tubular sponge, the diameter of the tubes being less than 3 mm., whose skeleton agrees almost exactly with the holotype of *H. striata* described by Hozawa (J. Imp. Coll. Sci. Tokyo, Vol. XXXVIII, Art. 5, p. 28) from Japan. The minima of the spicule-measurements given for Hozawa's specimens are approximately the equivalent of the maxima obtained in the present specimen, while the greatest diameter of its large, longitudinal oxea is .018 mm. as against .03—.09 mm. for Hozawa's specimens.

Family Grantiidae Dendy.

Uteopsis Dendy.

7. *Uteopsis argentea* (Poléjaeff). (Text-fig. 3).

Poléjaeff. Challenger Reports. Calcarea. Vol. VIII, 1884, p. 43.
Dendy & Row. The Classification and Phylogeny of the Calcareous Sponges, etc. Proc. Zool. London, 1913, p. 769.

Stat. 60. Haingsisi, Samau Island. 36 Meter.
Stat. 164. 1°42′.5 S., 130°47′.5 E. 32 Meter. 2 Ex.

The first sponge is in the form of several erect tubes, up to 2 cms. long, arising from a stolon-like tube creeping over the surface of a piece of rock. Apart from the fact that the erect tubes occasionally bear small papillate lateral outgrowths, the beginnings of fresh tubes it may be presumed, the specimen differs in no respect from the holotype.

Those from station 164 are more bush-like in appearance and consist of a number of tubes rising erect from an ill-defined basal plate.

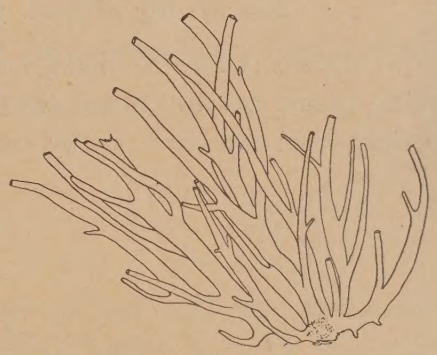
Leuconia Grant.

8. *Leuconia capillata* (Poléjaeff).

Poléjaeff. Challenger Reports. Calcarea. Vol. VIII, 1884, p. 55, Pl. II, fig. 1.
Dendy & Row. The Classification and Phylogeny of the Calcareous Sponges, etc. Proc. Zool. Soc. London, 1913, p. 770.

Stat. 240. Banda. From 9—45 Meter. 1 Ex.

The sponge is in the form of some six individuals arising from a common basal mass encrusting a shell, each individual having the typical appearance presented by the holotype.



Text-fig. 3. *Uteopsis argentea* Poléjaeff, to show branching, tree-like habit. About natural size.

The species was hitherto known only from the Philippines.

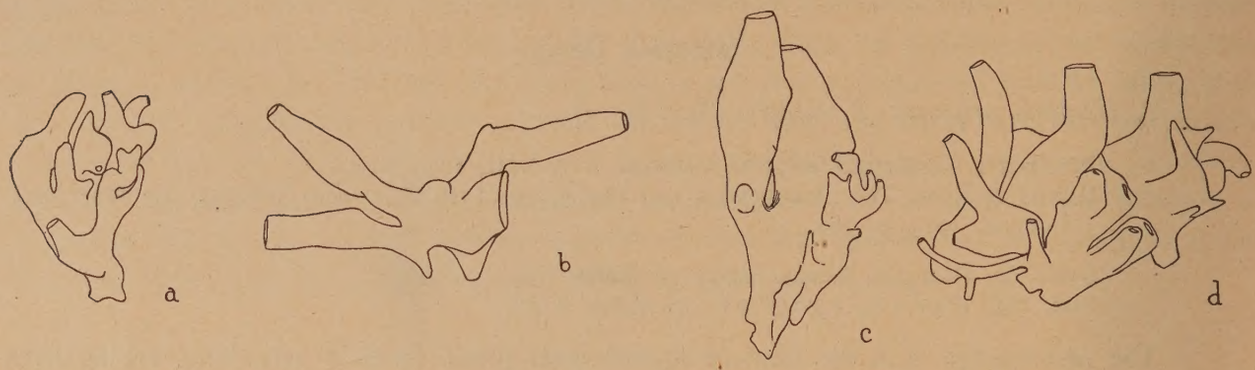
Anamixilla Poléjaeff.

9. *Anamixilla torresi* Poléjaeff. (Text-fig. 4).

Poléjaeff. Calcarea. Challenger Reports. Vol. VIII, 1884, p. 50, pl. IV, fig. 2.
Lendenfeld. A monograph of the Australian sponges. Proc. Linn. Soc., N.S.W., Vol. IX, p. 1109.
Dendy & Row. The Classification and Phylogeny of the Calcarea. Proc. Zool. Soc. London, 1913, p. 766.

Stat. 164. 1°42′.5 S., 130°47′.5 E. 32 Meter. 1 Ex.
Stat. 240. Banda. 9—45 Meter. 1 Ex.
Stat. 231. Amboina. 40 Meter.
Stat. 303. Haingsisi, Samau Island. Up to 36 Meter. 1 Ex.

The various specimens are all quite typical in so far as the structure of their skeleton



Text-fig. 4. *Anamixilla torresi* Poléjaeff. To show variation in external form. *a*. Holotype. *b—d*. Specimens from the Siboga collection. Natural size.

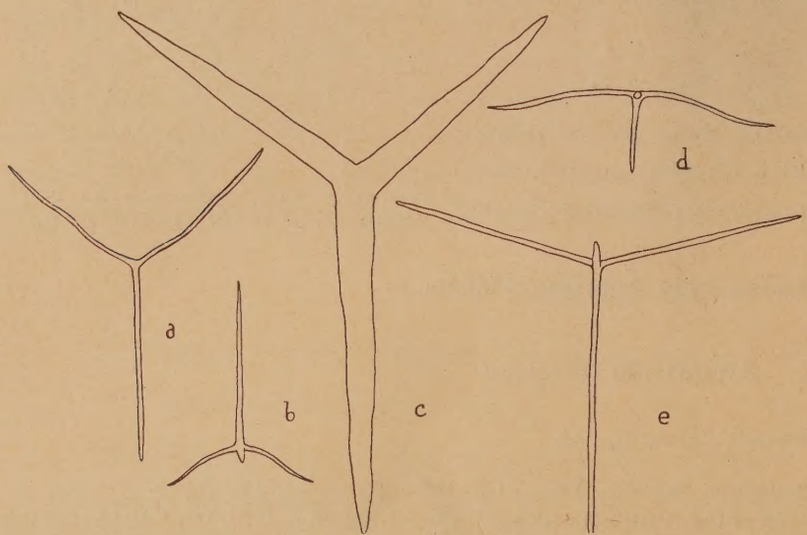
and the size of their spicules are concerned. There is some slight variation in the external form, the details of which are worth recording (see fig. 4).

The species has hitherto been found only in Australia.

10. *Anamixilla irregularis* sp. n. (Text-fig. 5).

Stat. 47. Bay of Bima. 55 Meter. 1 Ex.

Diagnosis. — Sponge erect, conical, tubular; surface harsh to touch; colour, in spirit, white; oscule apical; dermal skeleton of slender triradiates, with slightly flexuous rays, variable in size, basal ray .21—.33 by .006—.012 mm., oral rays .195—.24 by .006—.01 mm.; gastral skeleton of quadriradiates, facial rays .24 by .009 mm., apical ray projecting into gastral cavity, .09 mm. long; skeleton of chamber-layer composed of subgastral sagittal quadriradiates, few in number, with facial rays .09 by .008 mm., and apical rays, directed towards dermal surface, .24 by .009 mm., and a confused layer of large equiangular triradiates, with rays of unequal length, variable in size, rays measuring up to .7 by .045 mm.; skeleton of oscular margin, composed of quadriradiates, basal ray .39 by .006 mm., oral rays .3 by .006 mm., apical ray .075 by .006 mm., and slender and stout oxea, arranged longitudinally in dermis, measuring .3 by .003 mm., and 1.08 by .048 mm. respectively.



Text-fig. 5. *Anamixilla irregularis* sp. n.
a. Triradiate of dermal layer; *b*. subgastral sagittal quadriradiate; *c*. irregular triradiate of chamber-layer; *d*. gastral quadriradiate; *e*. quadriradiate of oscular rim. All × 100.

The finding of a species in which colossal longitudinal oxea are present only in a restricted area of the sponge, makes it doubtful whether the presence or absence of these spicules has the taxonomic significance ascribed to it by DENDY & ROW (1913). Actually, these authors emphasize the absence of longitudinal oxea in their diagnosis of the genus *Anamixilla*, so that, with the discovery of the present species this diagnosis must be altered accordingly.

A. irregularis differs from the only other known species of the genus in the presence of oxea in the oscular rim, the absence of the larger triradiates from the tangential dermal skeleton, the substitution of subgastral sagittal quadriradiates for subgastral triradiates, and the irregularity of the rays of the spicules of the chamber-layer.

The irregular character of the triradiates of the chamber-layer is, perhaps, the most distinctive feature of the species. Not only are the rays unequal in length but their surfaces are marked by numerous small irregularities and undulations.

Family AMPHORISIDAE Dendy.

Leucilla Haeckel.

11. *Leucilla australiensis* (Carter). (Text-fig. 6).

CARTER. Descriptions of sponges from the neighbourhood of Port Phillip Heads, South Australia. Ann. Mag. Nat. Hist., 1886, p. 133.
DENDY. Synopsis of the Australian Calcarea Heterocoela. Proc. Roy. Soc. Vict., 1892, p. 115.
DENDY & ROW. The Classification and phylogeny of the Calcarea. Proc. Zool. Soc. London, 1913, p. 783.

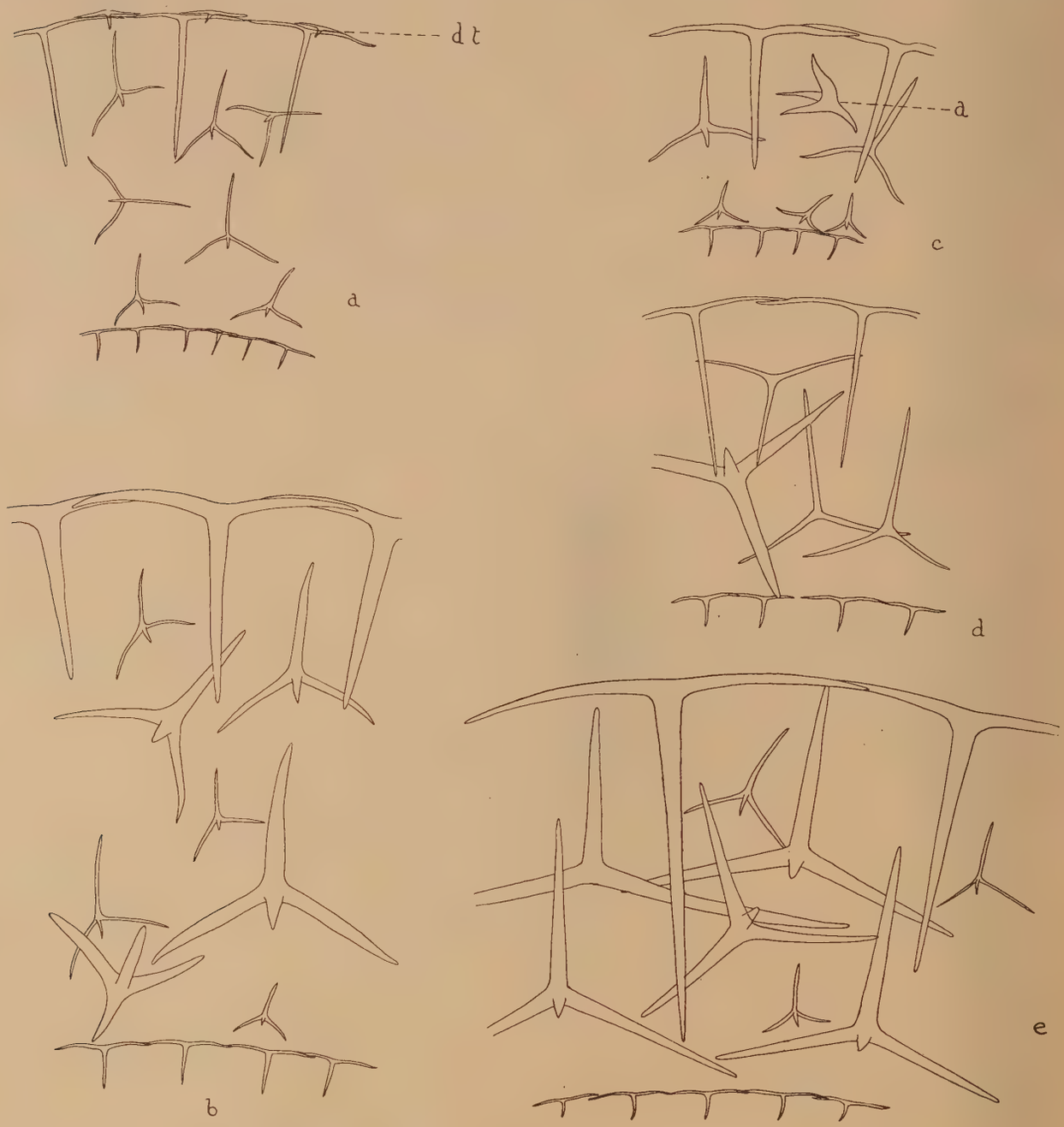
Stat. 240. Banda. From 9—45 Meter. 1 Ex.
Stat. 260. 5° 36′.5 S., 132° 55′.2. 90 Meter. 1 Ex.

Of the two specimens, the larger is sub-spherical, about 20 mm. high and very similar to the holotype in appearance. The second, about 6 mm. high, is conical.

The species was first described by CARTER (l. c.) under the name *Leuconia johnstonii* var. *australiensis*. DENDY, later, raised the variety to the rank of a species and referred it to the genus *Leucilla*. CARTER's original description is slightly inadequate and subsequent writers have added little to our knowledge of the species. Although the holotype is missing from the British Museum collection, DENDY has deposited there preparations from the twelve specimens recorded by him in 1892, and examination of these has shown that, while agreeing quite closely in general features with each other and with the holotype, so far as can be ascertained from CARTER's description, they nevertheless exhibit certain important differences.

In the first place, the dimensions of the spicules and the relative size of the various categories vary considerably,. Secondly, there are signs of an incipient differentiation into two categories on the part of the radiates, both triradiates and quadriradiates, filling the chamber layer. Then, again, the numerical proportions in which the various categories of spicules are present vary quite noticeably. For example, the chamber layer of one individual may be so crowded with spicules that it is almost impossible to make out their outlines satisfactorily,

while in another they may be only sparsely present. From one specimen the dermal tangential layer of small triradiates is, to all intents and purposes, absent, and strongly developed in



Text-fig. 6. *Leucilla australiensis* (Carter). *a—d.* Sections at right-angles to surface from DENDY's specimens from Port Phillip, Australia. (*a* = R.N. 96; *b* = R.N. 199; *c.* = R.N. 198; *d* = R.N. 202). *e* Section from a Siboga specimen. All semi-diagrammatic and drawn to same scale. *d. t.* dermal triaenes (these spicules have been omitted from all but fig *a*); *a.* abnormal triaene.

others. In one the number of gastral quadriradiates is almost negligible, in others abundant. More important than these numerical variations are the variations in the size and disposition of the spicules.

Fig. 6*a* shows what may be regarded as the typical appearance of the sponge in radial section. The spicules of the chamber layer are all more or less of one size and, for the most part, quadriradiates. Fig. 6*b* shows an increase in the size of the subdermal pseudosagittals and the radiates of the chamber-layer differentiated into two fairly definite categories. Fig. 6*c* shows the large radiates concentrated in that portion of the chamber-layer which contains the basal rays of the subdermal pseudosagittals and the smaller radiates confined to a narrow area immediately adjacent to the gastral wall. In Fig. 6*d* the smaller radiates are gone and the large radiates near the gastral surface tend to assume the appearance and position of subgastral sagittals. In fig. 6*e* both large and small radiates are present in the chamber-layer but the larger give rise to the pronounced appearance of a tubar skeleton.

The species was hitherto known from Australia only.

A Comparison of *Leucosolenia blanca*, *L. stipitata* and *L. lacunosa* with synonymies and diagnoses.

Before it is possible to discuss the distribution and specific characters of *Leucosolenia blanca*, *L. stipitata* and *L. lacunosa*, some attempt must be made to understand what is meant by these three species and to restore their past confused history to some degree of order. That the confusion should have arisen is, perhaps, not altogether surprising, for in these three species we are confronted with forms having similar external appearance, at least so far as the last two are concerned, similar spiculation and often, the same geographical distribution.

The confusion seems to have originated in an error made by MIKLUCHO-MACLAY (1868) in including in a single species a group of sponges obtained from the Canary Islands. This group, which he named *Guancha blanca* (l. c., pl. IV, fig. 1—2), contains individuals of three types: — *a*. stipitate, tubular sponges, occasionally giving rise to lateral buds to form colonies of slender tubes which, rarely, anastomose; *b*. massive sponges, with spherical clathrate bodies and stout stalks; *c*. repent sponges, also with clathrate bodies, encrusting the surface of the rock on which the other two are growing. He concluded, naturally enough, that these represented three forms or growth-phases of a single species, and supported this argument by diagrams to show alleged transitions between the various forms. With our knowledge of to-day, it is not difficult to realise that he had before him three different, though closely-related, species of calcareous sponges growing in close association with each other. Nor is it difficult to recognise in form *c*. (MIKLUCHO-MACLAY l. c. pl. IV, figs. 1 D, 2 D) the common *Leucosolenia coriacea* (Montagu).

We may assume that MIKLUCHO-MACLAY, in figuring the supposed transitional forms, took care to select those which would best show the point he wished to prove. Even so, his figures purporting to show that form *a*. may give rise to form *b* by further branching and coalescence are unconvincing. It is essential, therefore, that a type be chosen for his *Guancha blanca* before proceeding further with the discussion of the forms he figures. Accordingly, I choose the specimen figured in pl. IV, fig. 1 A as the type (lectotype) of the species.

The next step will be to determine what arguments there may be for and against the

view that a simple tubular form such as form *a.* may, by repeated budding and coalescence of the buds, give rise to form *b.*

The only evidence available, apparently, in favour of the argument is that given by HAECKEL in "Die Kalkschwämme" (Vol. 3). On pl. III of this work, the author has depicted the various growth-forms of *Leucosolenia coriacea* and according to his figures, this species begins life as a simple, stalked tube which may give rise to the typical form of the species by one of three methods: — *a.* by coalescence with neighbouring sponges; *b.* by the reproduction of lateral tubes which may coalesce; or *c.* by fission of the original body to give a clathrate form. If these figures could be relied on, we should have here the evidence we seek. Unfortunately, no other worker has recorded this sequence in the same, or any other species. Further, although very well acquainted with *L. coriacea*, both in the laboratory and in the field, I cannot recollect having seen any such growth-stages as HAECKEL depicts, nor have I seen a quarter of the forms he figures, although I have many times examined the rocks on which the species was growing. On the contrary, there is considerable justification for saying that the majority of the figures on this, and other plates of the same work, are probably the product of HAECKEL's imagination. If not that, then he has managed to mix his species very thoroughly until it is impossible to rely on anything contained in this particular work. If further proof of the unreliable character of the work were needed, we have only to turn to pl. VI. Here are depicted six growth stages in *Leucosolenia gracilis* a species obtained from California. In this also, we see a transition from a primitive *Olynthus*-individual to one with a clathrate body. The former is 1.9 mm. and the latter 5 mm. high, the natural assumption being, therefore, that individuals up to and including 2 mm. in height are of the *Olynthus*-type, but that soon after this they begin, by budding, coalescence, fission, or by some other process to give rise to the clathrate form. Unfortunately, this does not appear to be the case. Quite recently, some specimens of a calcareous sponge have been presented to the British Museum by Dr. M. W. DE LAUBENFELS, also collected on the coast of California. All have the same appearance as the clathrate individual represented in pl. VI, fig. 5 of HAECKEL's "Die Kalkschwämme". The smallest is barely 2 mm. high, the largest, 10 mm. high. This does not agree with HAECKEL's results. Moreover, there is no sign on the surface of the substratum on which they are growing of any *Olynthus*-individuals. There is, therefore, no convincing evidence in these that the *Olynthus*-individual does give rise to the clathrate form and one is led to suggest that if it does so at all, the change takes place at a very early stage in the post-larval period, in which case the *Olynthus*-forms would be of very small size and constituting only a transitory stage. In this case there could be no possibility of their reaching the size assumed by the *Olynthus*-forms figured by HAECKEL and MIKLUCHO-MACLAY. Moreover, DE LAUBENFELS' specimens, which should be identical with HAECKEL's *L. gracilis*, have triradiates only, whereas *L. gracilis* is said to have quadriradiates only.

On the other hand, there is considerable evidence that the *Olynthus*-forms, form *a.*, of the sponges figured by MIKLUCHO-MACLAY under the name of *Guancha blanca*, may exist in considerable numbers without giving rise to the clathrate form. In the British Museum collections there are some fifty specimens of a sponge from Naples, labelled *Leucosolenia blanca*, which answer in every respect to form *a.* of MIKLUCHO-MACLAY's species. These often give rise to lateral buds, thereby producing the colonial form bearing up to four *Olynthus*-individuals, but

these buds never coalesce, nor is there any sign that the Naples sponges give rise to the clathrate form. At the same time, there is a piece of rock in the same collection from Naples bearing clathrate individuals ranging from 1 to 15 mm. in height, but bearing no *Olynthus*-forms.

On the strength of the evidence given above, I would suggest, therefore, that the *Olynthus*-individuals and the stipitate, clathrate form of *Guancha blanca* represent two distinct species, the first to be known as *Leucosolenia blanca*, the second, for reasons to be discussed later, to be called *L. macleayi* (Lendenfeld).

Reverting once again to the species *Guancha blanca*, as understood by Miklucho-Maclay, we find the second stage in its history marked by a set of gross errors. Haeckel (1869*a*) referred the species to five different genera in the same work: — *Olynthus guancha*, p. 237; *Leucosolenia guancha*, p. 243; *Tarrus guancha*, p. 244; *Nardoa guancha*, p. 247 and *Guancha blanca*, p. 254. Later, the same author (1872, p. 38) apportions the species to seven different genera: — *Olynthus*, *Clistolynthus*, *Soleniscus*, *Nardorus*, *Tarrus*, *Auloplegma* and *Ascometra*. Then, he proceeds to divide the species into two, *Ascetta guancha* and *A. philippina*, and, in the same lines, re-converts these two species into two varieties of the same species, *Ascetta blanca* varr. *guancha* and *philippina*. This display is beyond comment, and it is no less astounding that Dendy and Row (1913) should have accepted the species "*Leucosolenia philippina* Haeckel" without giving some indication of what they understood by it. Actually, Haeckel adds nothing to our knowledge of the species, even ignoring for the moment the confusion he has caused in its nomenclature, except a spicule-drawing, a miserable caricature of the original drawing by Miklucho-Maclay, and the statement that its geographical distribution includes the Canary Islands, Brazil and the Philippines.

Vosmaer (1881) mentions the occurrence of *Ascetta blanca* at Naples, and one may assume that he had seen specimens similar to those already described from this locality, belonging to both *Leucosolenia blanca* and *L. macleayi*.

Poléjaeff (1883, p. 37) reported the occurrence of *Leucosolenia blanca* at the Azores but, unhappily, in return for some slight new information concerning the species, he adds further to its sorry history. He makes the astonishing statement that "no Auloplegma-forms of *Leucosolenia blanca* had previously been observed with well-developed peduncle", yet the 'Challenger' specimens differ little from form *b.* of Miklucho-Maclay's specimens. He also refers to the possession of a solid peduncle by the 'Challenger' specimens, yet the only one he cut, the smaller, has a hollow peduncle, while the larger, until recently intact, has a solid peduncle. He, further, establishes the variety *bathybia* without giving an adequate clue to the distinguishing feature of the variety and leaves us to assume that its characteristic feature is the possession of a solid peduncle. No measurements of spicules are given, only the absurd statement that the basal rays are "not more than 1.2 to 1.5 times as long as lateral rays", together with a drawing in which only portions of the spicules are shown. Again, the dimensions of the larger specimen are stated to be: — height, 25 mm., diameter of body, 15 mm., but my own measurements of this specimen give the body a diameter of 10 mm.

Actually, the 'Challenger' specimens are also identical with *L. macleayi* (Lendenfeld), and their spicules have the following dimensions: — basal rays, .075 mm., oral rays, .03 mm. long. The corresponding rays of the spicules of *L. macleayi* are .1 and .03—.04 mm. respectively,

those of form *b.* of "*Guancha blanca*", judging by the original drawings by MIKLUCHO-MACLAY, are .08 and .04 mm. respectively. There is, therefore, close agreement between the three forms in the dimensions of the spicules as well as in the external form.

The sponges recorded by HANSEN (1885, p. 20) from the North Atlantic belong evidently to a different species. The two sponges measured 30 and 14 mm. in height respectively, and their spicules had the following dimensions: — basal rays, .308 mm. long, oral rays, .244 mm. long. The large size of the spicules makes it impossible to regard these two sponges as representatives of *Leucosolenia blanca*, as HANSEN would have us think, and there can be little doubt that they belong to *Leucosolenia lacunosa* (Johnston), but as this species has been almost entirely ignored it is necessary to digress in order to make clear why this opinion concerning HANSEN's specimens should be held.

JOHNSTON (1842, p. 176, pl. XX, figs. 2, 3) described as *Grantia lacunosa* a small sponge presented to him by Mr. BEAN which had been found growing on the rocks at Scarborough. Its appearance is very like that of *Leucosolenia macleayi* and according to JOHNSTON it possesses only triradiate spicules. Unfortunately, no dimensions or drawings of the spicules were given in the original description. BOWERBANK (1874, p. 9, pl. IV, figs. 1—8) re-describes the species from material obtained from various sources, including a specimen collected by Mr. BEAN from Scarborough. Although the holotype of the species is lost, we have the reassuring knowledge that BOWERBANK obtained his information, in part at all events, from a specimen collected from the same locality as the type, and, for all we know to the contrary, at the same time. At all events, we need have little hesitation in accepting BOWERBANK's Scarborough specimen as truly representative of the holotype, and, with it, the other specimens described by BOWERBANK. The spicules of these specimens are extremely variable in size and distribution. In the triradiates, for example, the basal rays vary in length from .1 to .21 mm. and the oral rays from .045 to .09 mm. The oxea, which may attain a length of .32 mm. or more, are variable in their distribution, one specimen containing many, another few, and so on. *Leucosolenia (Ascandra) angulata* (Lendenfeld) from the Adriatic, (vide LENDENFELD 1891, p. 42) has a similar external form to *L. lacunosa*, and in this species the oxea measure from .45 to. .8 mm. The triradiates vary in size according to their position in the sponge, those of the stalk having basal rays .11—.2 mm. long and oral rays .045—.09 mm. long. The triradiates of the body have basal rays .12—.25 mm. long and oral rays .09—.12 mm. long. It is very doubtful whether there is such a clear differentiation between the spicules of the body and those of the stalk, as LENDENFELD would have us believe, although at first sight it may appear so. For example, in BOWERBANK's specimens the spicules around the oscule seem, at first sight, decidedly smaller than those of the rest of the body, but on more critical examination it is seen that the size of the spicules varies in all parts of the sponge but that a particular size may predominate in one place and another size in another part. The general agreement between *L. lacunosa* and *L. angulata* is sufficiently great, despite the minor differences they exhibit, to leave little doubt that they belong to the same species. And it is also extremely probable, notwithstanding the larger size of the spicules, that HANSEN's specimens of *L. blanca* belonged to the same species but that the oxea were very scarce and were overlooked, or, since they are known to vary in number in different individuals, that they may have been absent altogether.

The same may be said of LEVINSEN's specimen in which the basal and oral rays of the spicules measured .2 and .1 mm. respectively. Moreover, if HANSEN and LEVINSEN failed to examine the peduncles of their specimens, they would not find oxea as these spicules are chiefly confined to the basal parts of the sponge.

TOPSENT's (1892) specimens of *L. blanca* var. *bathybia*, ranging from 5 to 28 mm. in height, appear to correspond almost exactly with the typical form of *L. macleayi*.

LENDENFELD (1891, p. 34) appears to have confused specimens of *L. blanca* and *L. macleayi* and, influenced no doubt by MIKLUCHO-MACLAY's original description, described them as one species, *Ascetta blanca*.

BREITFUSS has recorded the species on many occasions (see synonymy list for *L. macleayi*) from various parts of the Arctic and from South Africa, and ARNESEN (1901, p. 9) has recorded it from Norway. In none of these cases is any clue given which might enable us to decide the exact identification of the sponges recorded but I propose to regard them all as examples of *L. macleayi*, pending re-examination of the material, for the following reasons: — *a.* in the minds of workers of the past the typical form of *L. blanca* appears to have been represented by the sponge with a stipitate, clathrate body (form *b.*); *b.* This form is the one most commonly met with outside the Mediterranean and the Canary Islands. There is one exception to this, however. *L. blanca* Breitfuss (1898, p. 13) appears to agree with the typical form of *L. blanca* (form *a.*) as here understood. Assuming this latter to be correct, *L. blanca* also occurs in the Arctic and, we may assume, in the waters of the Atlantic coasts of Europe. At the same time, the fact that it has not been recorded outside the Mediterranean, Canary Islands, and the White Sea, makes it probable that it is of rare occurrence elsewhere.

Clathrina blanca (Miklucho-Maclay) Jenkin (1908, p. 438, figs. 85—87) belongs almost certainly to a totally different species for which I propose the name *Leucosolenia jenkini* sp. n.

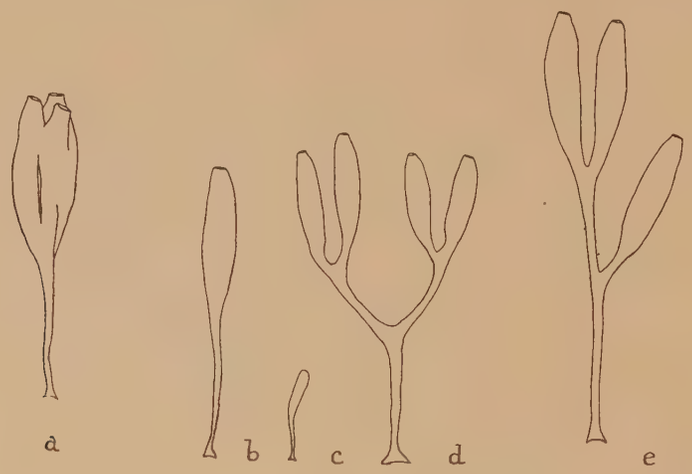
My reason for referring to form *b.* of *Guancha blanca* as *L. macleayi* may be explained here. DENDY (1891) described a species of *Leucosolenia*, *L. stipitata*, from Australia which is beyond doubt identical with POLÉJAEFF's *L. blanca* var. *bathybia* and, this much we may infer, with form *b.* of *Guancha blanca*. At the same time, he draws attention to the similarity between *L. stipitata* and *L. macleayi* (Lendenfeld 1885β) but decides that they represent distinct species because, according to LENDENFELD, *L. macleayi* has "a pseudogaster and pseudosculum, while in *Leucosolenia stipitata* there is no pseudogaster and the osculum is a true osculum". Remembering LENDENFELD's irresponsibility in the matter of nomenclature and terminology, and guided by the extremely great resemblance his species has to *L. stipitata*, there need be no hesitation in accepting the two species as synonymous.

Leucosolenia blanca (Miklucho-Maclay). (Text-fig. 7).

Guancha blanca Miklucho-Maclay 1868, p. 221, pl. IV, fig. 1 A, B, etc.
Ascetta coriacea (pars) Haeckel 1872, pl. III, figs, 1, 2, 3, 4 (pars), 6, 7, 8.
Ascetta blanca (pars) Vosmaer 1881, p. 5; Lendenfeld 1891, p. 219.
Leucosolenia blanca Breitfuss 1898, p. 13; Dendy & Row 1913, p. 724 (see also Haeckel 1872, p. 38).

Diagnosis. — Sponge small, tubular, stipitate, often giving rise, by budding, to small

colonies of tubular individuals seldom exceeding 3 mm. in height; spicules equiangular, sagittal triradiates, basal rays .075—.09 mm. long, oral rays .03—.045 mm. long.



Text-fig. 7. *Leucosolenia blanca* (Miklucho-Maclay). *a*. One of MIKLUCHO-MACLAY's specimens to show coalescence; *b—e*. Specimens from Naples. × 100.

Distribution. — Mediterranean; Canary Islands; White Sea.

Leucosolenia lacunosa (Johnston).

Grantia lacunosa Johnston 1842, p. 176, pl. XX, figs. 2, 3.
Leucosolenia lacunosa Bowerbank 1866, p. 32; Id. 1872, p. 9, pl. IV, figs. 1—8; Dendy & Row 1913, p. 722; Breitfuss 1927, p. 27.
Ascetta blanca Hansen 1885, p. 20.
Leucosolenia blanca Levinsen 1886, p. 342.
Ascandra angulata Lendenfeld 1891, p. 227, pl. VIII, figs. 9—14; Arnesen 1901, p. 13; Id. 1901*a*, p. 68.
Leucosolenia angulata Dendy & Row 1913, p. 721; Breitfuss 1927, p. 27.

Diagnosis. — Sponge stipitate, with clathrate body which may be spherical, more or less oval, or laterally compressed; spicules sagittal triradiates and angulate oxea; basal rays of triradiates .21—.6 mm. long, oral rays .12—.308 mm. long; oxea .3—.8 mm. long; oxea of irregular distribution, but occurring for most part in stalk, often present in small quantities only.

Distribution. — Arctic generally; Atlantic coasts of Europe; Mediterranean.

Leucosolenia macleayi (Lendenfeld). (Text-fig. 8).

Guancha blanca (pars) Miklucho-Maclay 1868, p. 221, pl. IV, fig. 1C, etc.
? *Ascetta coriacea* (pars) Haeckel 1872, pl. III, figs. 4 (pars), 9—14, 21—24, 33.
? *Ascilla gracilis* (i. e. *Nardorus gracilis*) Id. l. c., pl. VI, fig. 5.
Ascetta blanca (pars) Id. l. c., p. 38.
Ascetta blanca (pars) Vosmaer 1881, p. 5.
Leucosolenia blanca var. *bathybia* Poléjaeff 1884, p. 37, pl. I, fig. 2; pl. III, fig. 3; Topsent, 1892, p. 22, pl. V, fig. 3.
Ascetta macleayi Lendenfeld 1885 *β*, p. 1086.
Ascetta blanca (pars) Lendenfeld 1891, p. 219.
Leucosolenia stipitata Dendy 1891, p. 51, pl. I, figs. 4—6, pl. IV, fig. 2, pl. IX, fig. 5.

Leucosolenia pulcherrima Id. l. c.,, p. 52, pl. I, fig. 7, pl. IV, fig. 3, pl. X, fig. 3.
Leucosolenia blanca et varr. *guancha, philippina, bathybia* Breitfuss 1896, p. 1; *L. blanca* Id. 1898*β*, p. 19—20; Id. 1898*η*, p. 210; Id. 1898*θ*, p. 16.
Ascetta blanca Arnesen 1901, p. 9.
Ascandra lacunosa Breitfuss 1911, p. 224; *L. blanca* Id. l. c., p. 224; Id. 1912, p. 72.
Leucosolenia blanca (pars) Dendy & Row 1913, p. 724; ? *L. gracilis* Id. l. c. p. 725; *L. macleayi* Id. l. c., p. 726; *L. philippina* Id. l. c., p. 726; *L. pulcherrima* Id. l. c., p. 727; *L. stipitata* Id. l. c., p. 727; *L. blanca* Breitfuss 1927, p. 27.

Diagnosis. — Sponge stipitate, with clathrate body which may be spherical, subspherical, or laterally compressed and foliate; oscules, when present, situated at upper surface and may be single or numerous; spicules equiangular, sagittal triradiates, with ends of rays acute or obtuse, basal rays measuring, .09—.2 mm. and oral rays, .03—.1 mm. long.

Remarks. — In addition to the synonyms of *L. macleayi* already suggested in the preceding discussion, a few more must be added. Haeckel's figures (l. c., pl. III), which are supposed to be those of *L. coriacea*, probably represent forms of *L. macleayi*. His *Ascilla gracilis* is (l. c. pl. VI), as has already been pointed out, a mixture, apparently, of several species, and, since no holotype appears to have been selected, I choose the specimen represented by fig. 5 for the type. This latter is almost certainly a synonym of *L. macleayi* but until re-examination of the type can be made, I do not propose to use the name *gracilis* to replace one of which the type is known with far greater certainty.

Dendy (1891, p. 53) says of *L. pulcherrima,* "This species is obviously closely related to *L. stipitata* and I should not be surprised to find a perfect series of intermediate forms". Although these intermediates have not been obtained yet from Australian waters, a perfect series can be formed from among the various specimens recorded from various parts of the world. From the collection of sponges belonging to this species, collected at Naples and now in the British Museum, intermediates between Dendy's two species are quite common.

In justification of the distinction here made between *L. blanca* and *L.macleayi,* an attempt is made (figs. 7, 8) to express by line-drawings the form assumed by the individuals of each species. No attempt has been made to illustrate the pattern produced by the anastomosis of the tubes by which the body of *L. macleayi* is built up, since this feature has already been sufficiently well illustrated by the various authors referred to in the above list of synonyms. So far as can be seen, the species may have a hollow or a solid stalk, may have conspicuous oscules, one or more, or none at all, and may vary considerably in form. The solid stalk is probably produced in response to the need for such an organ, either as the result of disturbing wave action or in response to the increased weight of the body. If the latter we should expect to find the solid stalk only in the larger individuals. While this is usually the case, it is by no means always true.

In the Naples collection, already referred to, the sponges were growing thickly massed together on a piece of rock. As a consequence, the majority were laterally compressed. Those which were growing in more isolated positions were more or less spherical. Further, most of the larger specimens possessed several stalks and showed abundant signs that considerable coalescence between neighbouring individuals had taken place, probably the result of overcrowding, also.

So far as the post-fixation development of the sponge is concerned, it is difficult to

Textfig. 8. *Leucosolenia macleayi* (Lendenfeld). Outline-drawings to show the variation in external form in the species. *a—c.* Three specimens described by MIKLUCHO-MACLAY under *Guancha blanca*. *d.* The holotype of *Leucosolenia stipitata* Dendy. *e.* The holotype of *L. pulcherrima* Dendy. *f.* A co-type of *L. stipitata*. *g.* The holotype of *L. macleayi*. *h.* A specimen from California collected by Dr. M. W. DE LAUBENFELS. *i—j.* The Challenger specimens of *L. blanca* var. *bathybia*. *k—q.* Specimens from Naples, showing various growth-forms and several cases of the coalescence of neighbouring individuals: *l* shows the production of lateral peduncles in a specimen growing in an angle of the rock. *r.* A specimen from South Georgia in the British Museum collection. *s.* The Siboga specimen. *t.* A young specimen from Norway showing the manner of growth of the body. *u.* The smallest known specimens of the species, from Naples. Figs. *a—s*, × 4: figs. *t*, *u*, × 7.

speak with any certainty, but such data as are available tend to confirm my views concerning the distinction between *L. blanca* and *L. macleayi*. On the piece of rock from Naples already referred to, there were some forty to fifty sponges, all belonging to *L. macleayi*. Of these, only three (fig. 8*u*) gave any clue to the course of events immediately following the fixation of the larva. The first two were simple tubes, almost identical with the unbranched individuals of *L. blanca* but without the oscule and only .1 mm. in height. The third, 4 mm. high, was already slightly clathrate, and at the apex of the sponge were a number of blunt tubular processes, in the act, we may assume, of growing outwards to coalesce and give rise to the typical clathrate network. In connection with the last specimen, it is interesting to note that in a small specimen from Norway (fig. 8*t*) the upper end of the stalk bears a number of blunt tubular processes also. From this scanty evidence it appears that the clathrate body in *L. macleayi* is produced, not so much by the budding off and coalescence of secondary tubes from the sides of a primary individual, as by the production of several blunt, tubular processes simultaneously, at the apex of the young sponge, which grow out and coalesce.

Distribution. — Practically cosmopolitan.

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